

GMI Capabilities

We describe the capabilities of the Global Modeling Initiative (GMI) chemical transport model (CTM) with a special focus on capabilities related to the Atmospheric Tomography Mission (ATom). Several science results based on GMI hindcast simulations and preliminary results from the ATom simulations are highlighted. We also discuss the relationship between GMI and GEOS-5.

GMI Capabilities

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Model Information

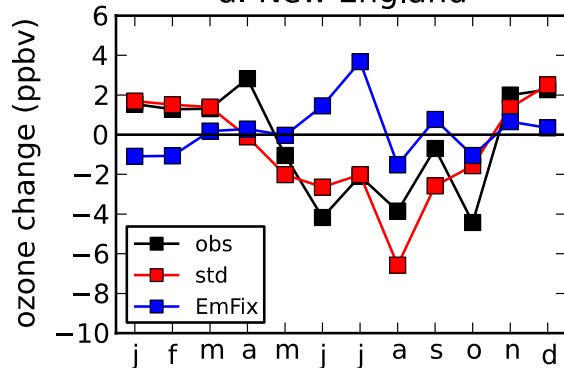
- The Global Modeling Initiative (GMI) CTM includes the following:
 - Stratospheric & tropospheric chemistry with 124 species (including the reactive nitrogen species & oxidants measured by Atom), >400 reactions
 - Diagnostics for individual reaction rates
 - Output for specific station locations
 - Specialized tracers including e90, idealized lifetime tracers, tendencies due to chemistry/advection/etc.

Recent GMI Simulations

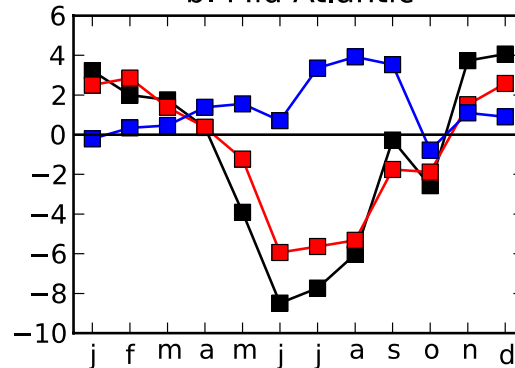
- Suite of Long Hindcast simulations:
 - 1990-2012 with time-dependent fossil fuel & biomass burning emissions
 - 1990-2012 with fixed emissions
 - 1979-2012 CCMI hindcast
- ATom simulations:
 - 1x1.25 degree horizontal resolution, 72 levels (~30 from 0-12km)
 - Meteorology from MERRA (MERRA2 coming soon)
 - Hindcasts possible within 1-3 months of met field availability

Recent Science Highlights

a. New England

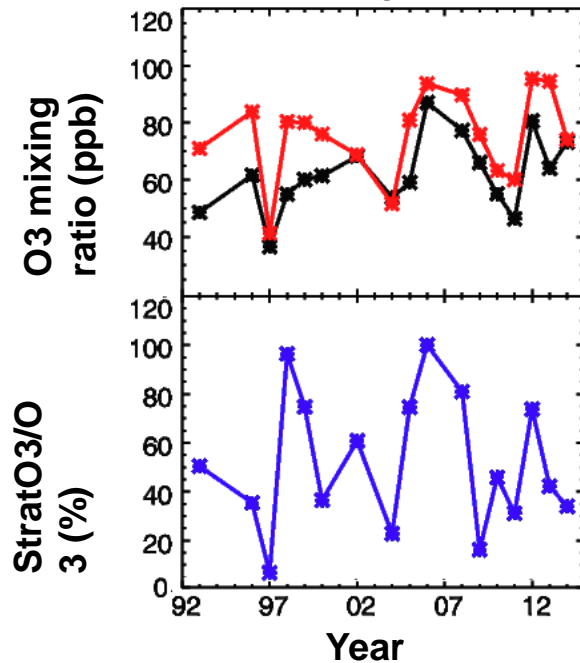


b. Mid Atlantic

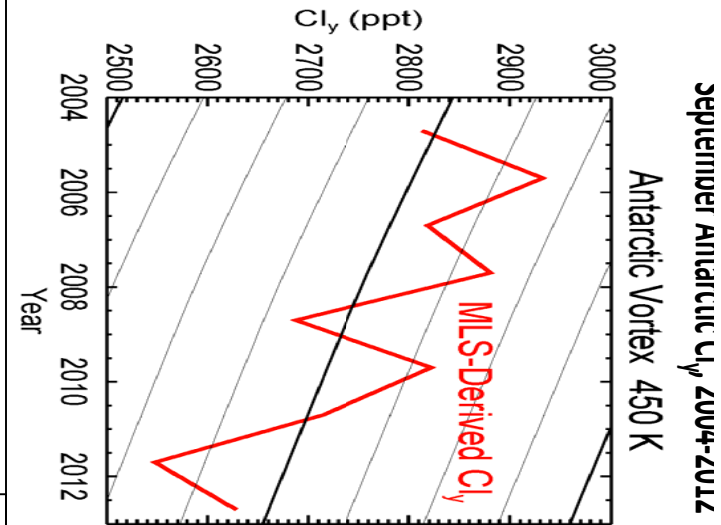


GMI Hindcast with time-dependent emissions captures observed changes in the annual cycle of U.S. surface O_3 .

July

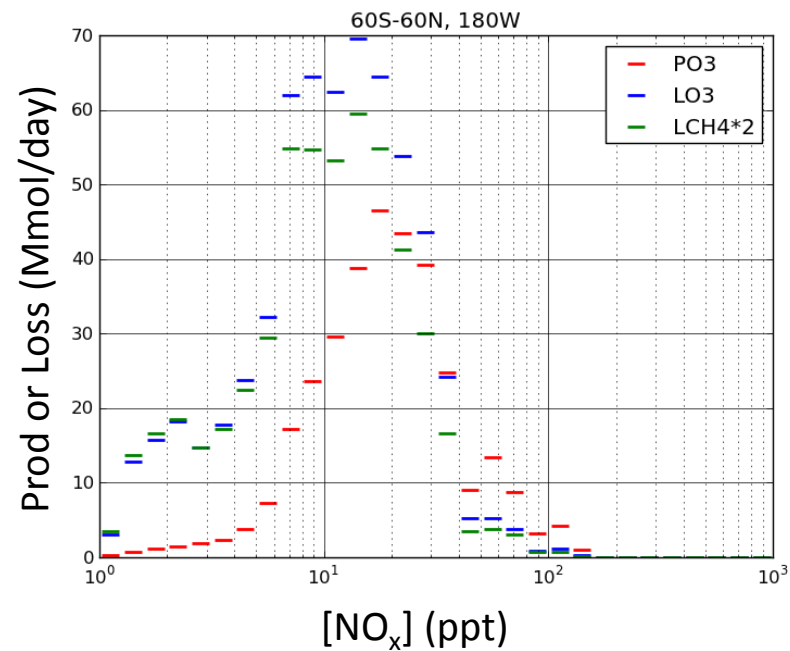
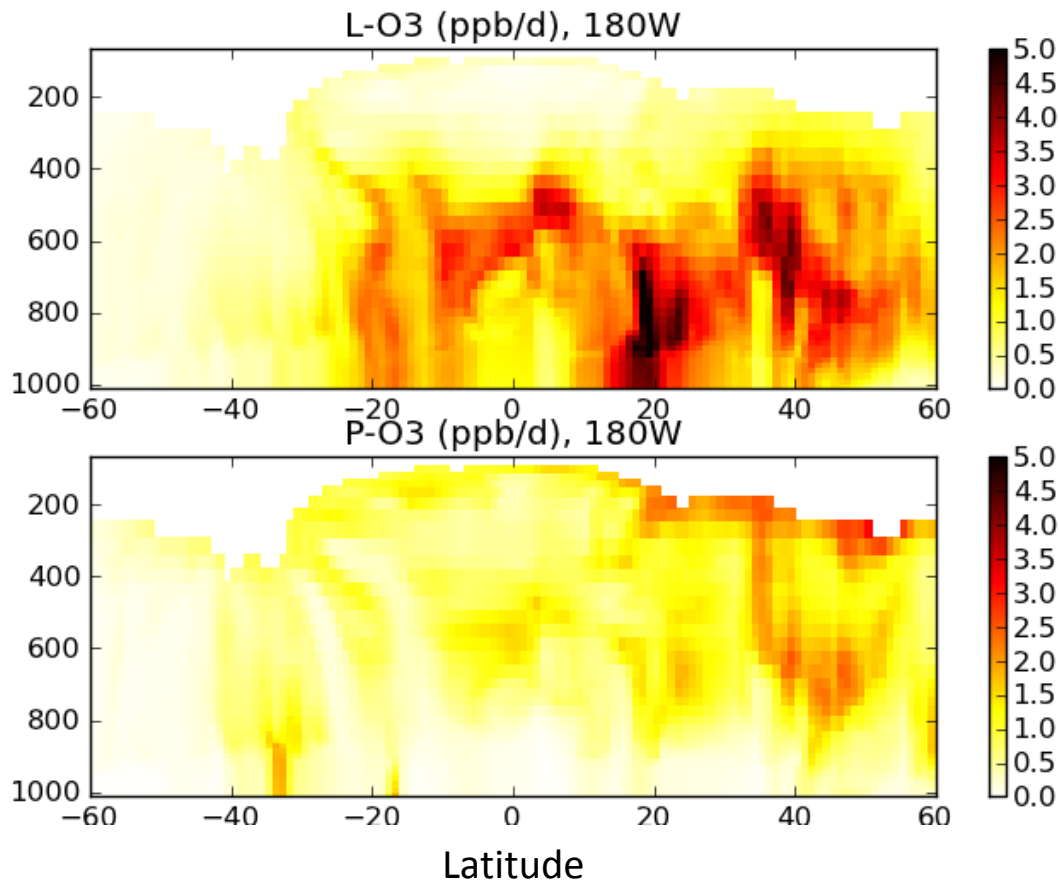


GMI results suggest that the IAV of tropospheric ozone over Reunion is mainly driven by the IAV of stratospheric contribution.



Inorganic chlorine causes ozone depletion but its level inside the vortex is not measured. We inferred chlorine levels during the past decade using a method that combines MLS N_2O data and the time-dependent N_2O/Cl_y correlation determined by the GMI Hindcast.

Preliminary ATom Results

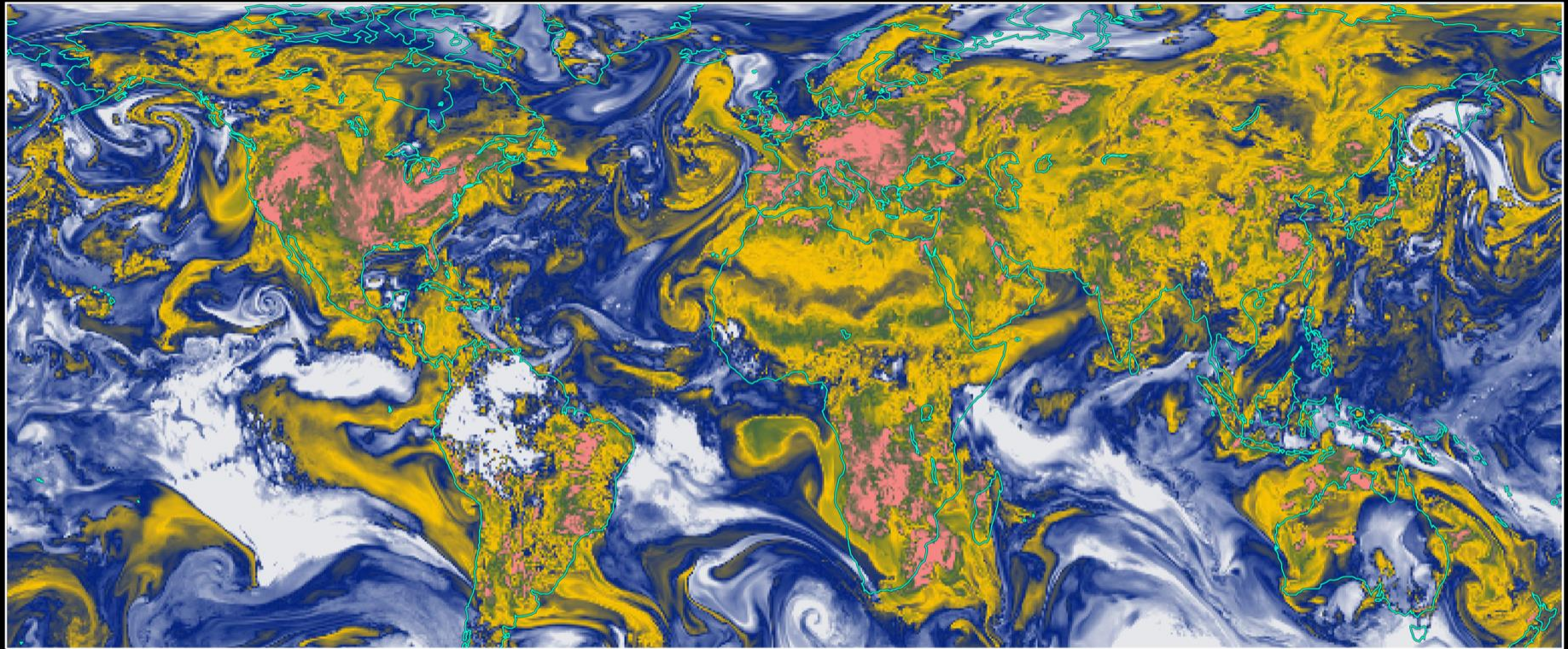


Relationship to GEOSCCM

- The GMI chemical mechanism is also included in the GEOS-5 Chemistry Climate Model (GEOSCCM)
- GEOS-5 can run as a free-running GCM, “replay” to a reanalysis, or run as a CTM (GEOS-CTM)
 - Can use recently produced met fields
 - High resolutions (up to 1/8 degree) are possible

High Resolution GEOSCCM Result

NO + NO₂ 1.8 km Above Ground



Fri 10 Aug
2012

Sat 11 Aug

Sun 12 Aug

Mon 13 Aug

Tue 14 Aug



Global Modeling and Assimilation Office
NASA Goddard Space Flight Center

0.75

1.00

1.25

1.50

1.75

2.00

2.25

2.50

log₁₀ pptv

GEOS-5 CCM
12.5 km x 12.5 km